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(54) Dialysing device

(57) A dialysing device for continuous ambulant peritoneal dialysis comprises a peritoneal catheter 1, a tube 2, a dialysing liquid container 5 and a regeneration system 8 containing selective absorbents and/or ion exchangers 9. As shown, the regeneration system 8 is located in the tube 2, but it may be fixed to the outside of container 5 (Fig. 2 not shown), fixed to the inside of container 5 (Fig. 3a not shown), or float freely within container 5 (Fig. 3b not shown). The regeneration system is provided with filters 10, (11).

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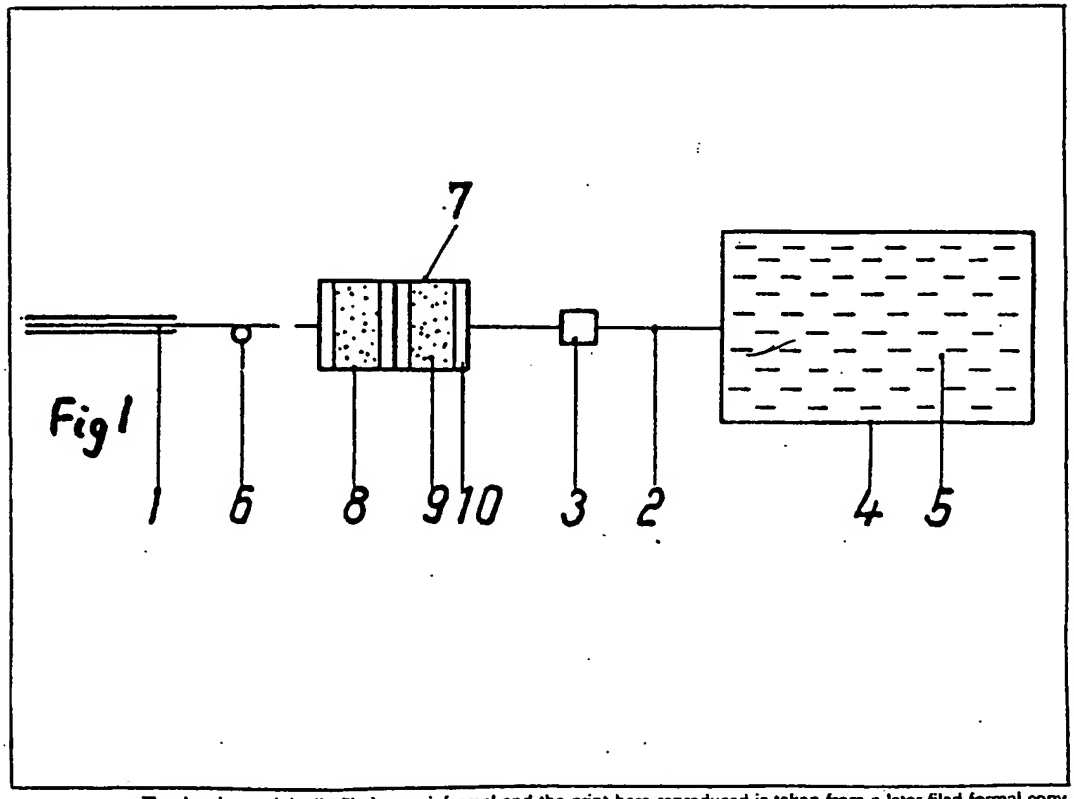

Fig 1

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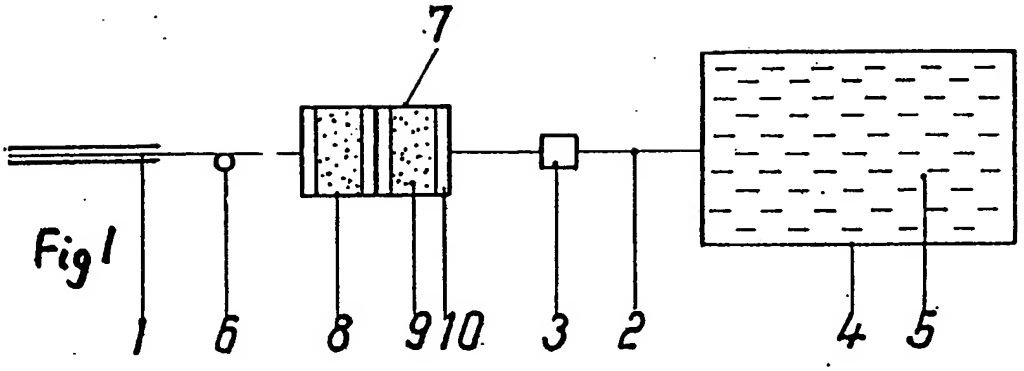

Fig 1

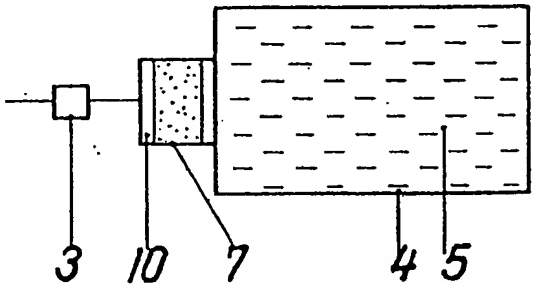

Fig 2

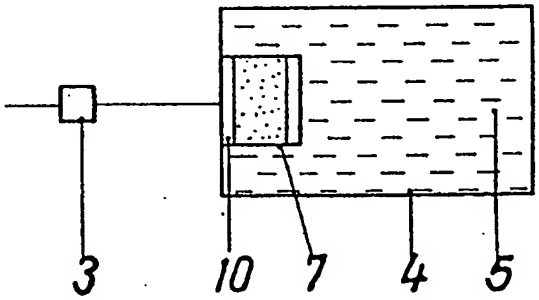

Fig 3

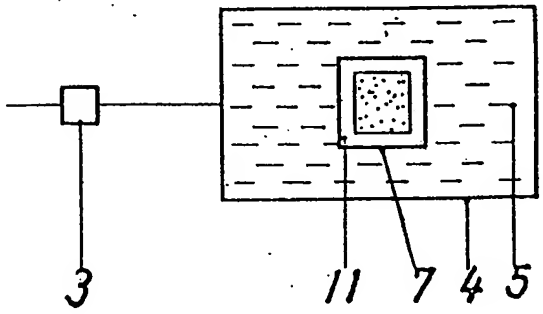

Fig 4

SPECIFICATION

Dialysing device

The invention relates to a dialysing device and more particularly to a dialysing device with a regeneration system for peritoneal dialysis, particularly continuous ambulant peritoneal dialysis, in order to cover the group of patients to whom a haemodialysis can no longer be supplied for various reasons, for example, age, diseases or infections and the like.

According to German published application DE-OS 2149040, a device for peritoneal dialysis in a constant stream is known. In this case the dialysate is constantly regenerated in a closed system. Disposed in the stream of dialysate is a regeneration device which consists of a urea separating column, an activated carbon column, a transparent length of rubing with an ultravoilet light source, a flow regulator and a filter. The urea separating column contains a material which absorbs urea. The activated carbon column serves to absorb creatinine, uric acid and other toxic substances. The dialysate liquid is sterilized by means of the ultraviolet light source in the transparent length of tubing in order to prevent the growth of bacteria. The flow of dialysate liquid through the apparatus is controlled by means of the flow regulator. The constantly flowing stream of dialysate liquid is maintained by a liquid pump. The whole device is so designed that it can be carried by a consists in that the whole construction is relatively complicated, a drive device with an energy source is needed and the patient is restricted in his freedom of movement to some extent because of the compact form of construction of the apparatus. Because of the small amount of dialysate liquid used, about one litre, and because of the continuous dialysate circulation, the urea separating column and the activated carbon column often have to be changed, as a result of which the risk of peritonitis is increased.

These disadvantages are partially overcome by continuous ambulant peritoneal dialysis (CAPD). The dialysing device used for this consists of a peritoneal dialysis indwelling catheter, a tube system and a dialysing liquid container. The dialysing liquid is introduced into the abdominal cavity of the patient by free fall via the tube system from the dialysing liquid container. The actual exchange of substances takes place while the dialysing liquid remains in the abdominal cavity, the peritoneum serving as a dialysis membrane. During this time, the dialysing liquid container remains connected to the tube system and is carried on the body by the patient.

After about 4–6 hours, the dialysing liquid container is suspended in a low position so that the dialysing liquid enriched with water and the dialysable substances and poisons can run back into this again. The patient removes this dialysing liquid container and exchanges it for a new one. Thus the dialysis patient becomes practically independent of the hospital because only the change of the transfer system has to be carried out under hospital conditions. The advantages of CAPD lie, above all, in the fact that the method works permanently like the healthy kidney and so large fluctuations in the water and electrolyte content and in the whole uramic metabolism position are avoided.

With all these advantages, the possible risk of peritonitis must be heeded during the CAPD treatment. On the average, the dialysing liquid container has to be changed four times a day so that the danger of peritonitis is relatively great.

The present invention seeks to provide a regeneration system for a dialysing device for CAPD through which the freedom of movement of the patient is increased and the danger of peritonitis is largely reduced and the costs of the dialysis treatment can be reduced.

The present invention also seeks to provide a dialysing device with a regeneration system in such a manner that it is simple in construction and permits an extension of the dialysate exchange time.

According to the present invention there is provided a dialysing device with a regeneration system for continuous ambulant peritoneal dialysis, consisting of a peritoneal dialysis indwelling catheter, a tube line and a dialysing liquid container, wherein the regeneration system consists of one or more regeneration elements with selective absorbents or ion exchangers or mixtures thereof.

The regeneration element may advantageously be formed from a rigid housing unit of flat construction or from a flexible foil unit with a filter system disposed at the inlet and one at the outlet.

The regeneration system is preferably disposed inside the tube system and rigidly connected to this. A further possibility consists in that the regeneration system is disposed at the inlet or outlet of the dialysing liquid container and is rigidly connected to this.

In a preferred embodiment, the absorbents or ion exchangers are enclosed by a filter system permeable to liquid. One of more of these regeneration elements are disposed for free movement inside the dialysing liquid container.

After the dialysing liquid has been introduced into the abdominal cavity of a patient from the dialysing liquid container via the tube system and the dialysis indwelling catheter and has remained there for several hours, the dialysing liquid enriched with urea, uric acid, creatinine and other toxic substances as well as with ultrafiltrate, is conveyed out of the abdominal cavity back into the dialysing liquid container via the regeneration system.

Urea, creatinine and other toxic substances are bound by the absorbents or ion exchangers in the regeneration elements so that a largely purified dialysing liquid is again available. This can now be supplied one or more times to the patient until the absorbents in the regeneration elements are used up. In the course of this it is necessary for some of the dialysing liquid enriched by the ultrafiltrate occurring to be removed from the dialysing device via an intermediate injection member. Furthermore, it is possible to regulate the dialysing liquid stoichiometrically and to add medicaments through this intermediate injection member.

Preferred embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, of which:

Figure 1 shows a dialysing device for CAPD in accordance with a first embodiment of the present invention with a regeneration system connected to the tubing;

Figure 2 shows a dialysing liquid container in accordance with a second embodiment of the present invention with a regeneration system disposed at the inlet or outlet; and

Figures 3a and 3b show an arrangement of the regeneration system inside the dialysing liquid container of dialysing devices in accordance with third and fourth embodiments of the present invention.

The dialysing device for CAPD consists of a peritoneal dialysis indwelling catheter 1, and tube line 2 with an intermediate injection member 3 and a dialysing liquid container 4. This is filled to about two thirds with a dialysing liquid 5 which is conveyed into the abdominal cavity of the patient via the tube line 2 and the peritoneal dialysis indwelling catheter 1. The tube line 2 is closed by means of a roller clip 6 and the dialysing liquid 5 remains in the abdominal cavity for several hours.

In the arrangement of Fig. 1, a regeneration system 7 is incorporated in the flexible tube line 2. This regeneration system 7 consists of one or of a plurality of regeneration elements 8. The regeneration elements 8 are filled with selective absorbents 9 or ion exchangers or mixtures thereof depending on the necessity for eliminating harmful substances from the used dialysing liquid 5.

The regeneration element 8 consists either of a rigid housing unit of flat construction or of a flexible foil unit. A filter system 10 is inserted at the inlet and one at the outlet and these ensure the location of the absorbents 9 or ion exchangers inside the casing during the operation of circulation or flow of the dialysing liquid 5 through the regeneration elements.

The regeneration elements are rigidly connected to the tube system 2, for example by adhesion or welding.

In Fig. 2, the regeneration system 7 is disposed outside the dialysing liquid container 4, at its inlet or outlet, a direct positive connection being formed between regeneration system 7, dialysing liquid container 4 and tube line 2.

Figs. 3a and 3b show the arrangement of regeneration systems 7 inside the dialysing liquid container 4. On the one hand, the regeneration system 7 may be connected directly to the inlet or outlet (3a). On the other hand, the regeneration system 7 may be freely movable in the dialysing liquid container 4 (3b). In this case, the regeneration system 7 consists of a filter unit 11 which is permeable to liquid and which encloses the absorbents 9 or ion exchangers.

Another varient, which is not illustrated in the drawing, would be for a regeneration system 7 with a mixture of absorbents 9 to be disposed in the dialysing liquid container 4 and for a regeneration element 8 with a selective absorbent 9 to be in the tube line 2.

Furthermore, it is possible for the absorbents 9 or ion exchangers to be free in the dialysing liquid container 4 in which case a filter system is disposed at the inlet or outlet.

The advantages of the solution according to the invention consist in that the regeneration system incorporated in the dialysing device ensures a partial or complete regeneration of the dialysing liquid so that the exchange time of the dialysing liquid container with the tube system can be effected at longer intervals. This means, on the one hand, that the danger of peritonitis feared with CAPD is considerably reduced. On the other hand, the freedom of movement for the patient is increased because he is saved some of the very time-consuming disinfection work.

The multiple use of the dialysing liquid leads to a reduction in the albumin loss (which can, however, be compensated for by appropriate nutrition) and renders possible a re-use of incorporated minerals which are dissolved during the first flow of dialysing liquid. CAPD is an inexpensive and comparatively very effective form of dialysis for the patient suffering from a chronic disease of the kidney. With the reduction in the former disadvantages of CAPD, particularly peritonitis, it is possible to cover a considerably wider group of patients so that the patients are saved the general disadvantages of haemodialysis in an extracorporal circuit (discontinuous treatment time, being attached to hospital devices, restrictions in liquids and diet and the like). As a portable artificial kidney, CAPD thus represents a true alternative to haemodialysis.

CLAIMS

1. A dialysing device with a regeneration system for continuous ambulant peritoneal dialysis, consisting of a peritoneal dialysis indwelling catheter, a tube line and a dialys-

ing liquid container, wherein the regeneration system consists of one or more regeneration elements with selective absorbents or ion exchangers or mixtures thereof.

2. A dialysing device according to claim 1, wherein the regeneration system is disposed inside the dialysing liquid container.

3. A dialysing device according to claim 2, wherein the absorbents and/or ion exchangers are enclosed by a filter system which is permeable to liquid.

4. A dialysing device according to claim 2 or 3, wherein one or more regeneration elements is/are disposed for free movement inside the dialysing liquid container.

5. A dialysing device according to claim 1, wherein the regeneration system is disposed outside the dialysing liquid container.

6. A dialysing device according to claim 5, wherein the regeneration system is disposed in the tube line and is rigidly connected thereto.

7. A dialysing device according to any of claim 1, 5 or 6 wherein the regeneration system has a filter means disposed at its inlet and outlet.

8. A dialysing device according to claim 1 or any of claims 5 to 7, wherein the regeneration system comprises a rigid housing unit of flat construction.

9. A dialysing device according to claim 1 or any of claims 5 to 7, wherein the regeneration system comprises a flexible foil unit.

10. A dialysing device according to any preceding claim, wherein the regeneration system is disposed at the inlet or outlet of the dialysing liquid container and is rigidly connected thereto.

11. A dialysing device substantially as herein described with reference to Figs. 1, 2, 3a or 3b of the accompanying drawings.

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